

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of

Hurricane Michael Preparation and
Response

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PS Docket No. 18-339

COMMENTS OF VERIZON

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December 17, 2018

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I. INTRODUCTION

Hurricane Michael smashed into the Florida Panhandle in the early afternoon hours of October 10, 2018. The storm brought driving rain and peak winds of 155 mph, just below Category 5 strength, making it the most powerful hurricane on record to strike the area and one of the most powerful to hit the United States. Michael hit hardest where it made landfall near Panama City, Florida and 20 miles inland, with an impact similar to Hurricane Maria’s in Puerto Rico last year. The high winds and debris from falling trees, toppled structures, and flying objects flattened homes and businesses, blocked streets and highways, and wiped out much of the area’s electric and communications infrastructure. As the storm approached, residents in much of Bay County (which includes Panama City), Gulf County and other counties were ordered to evacuate. After the storm, curfews were imposed for nearly a month. Even as they were being cleared, roads were jammed during daylight hours as residents, contractors and others sought to survey the damage, make repairs and otherwise cope with the crisis. In this

environment, utility and communications services took weeks to restore.¹ Nearly two weeks after the storm, electric power still had not been restored to 15-20,000 customers in the area. Water and sewer services were not fully operational in Panama City until October 24.

In advance of the storm, Verizon's network resiliency and hurricane preparedness efforts to protect and restore our network mimicked the efforts that enabled us to maintain and restore service promptly after Hurricanes Harvey and Irma in 2017, after Hurricane Florence in 2018, and again during and after California's recent wildfires. Verizon has deployed dozens of cell sites throughout the Panama City area, supported by a fiber backhaul network with three levels of redundancy, and the potential impact of hurricanes was incorporated in our network design in many ways: multiple levels of fiber redundancy; cell sites deployed above flood stage; battery and generator backup equipment (with full fuel tanks) already on site; deployable facilities pre-positioned in secure properties close to coastal areas; and employees and crews on standby to repair cell site and fiber facilities as needed.

In most areas of the country affected by Michael, these efforts minimized customer disruptions, ensured reliable communications for first responders and the public during and after the storm, and enabled us to restore wireless service within a few days, in line with what has occurred after most major storms. But the Panama City area took longer—12 days—due to the initial and ongoing damage done to the fiber rings there. Fiber crews worked 24 hours a day to make repairs, but debris from the storm blocked access to fiber rings, and clearance activity afterward resulted in repeated fiber cuts by electric contractors, road contractors, and

¹ See <https://www.insurancejournal.com/news/southeast/2018/10/22/505288.htm>; <https://dailyenergyinsider.com/news/15597-power-restored-to-more-than-95-percent-of-customers-following-hurricane-michael-gul-power-says/>.

homeowners attempting to make their own repairs. This result did not meet our expectations, and was frustrating to us and, more importantly, to our customers. Verizon is still assessing Michael and its aftermath, but a number of lessons have been learned that Verizon is already incorporating into its internal policies and practices. These include, among other things: expanding the use of temporary satellite equipment when fiber links are destroyed; improving communications with power companies and residents to prevent fiber cuts as fiber backhaul is repaired and restored; reviewing the optimal mix of aerial and underground fiber in coastal areas; and continuing to work through technical and operational challenges to implementing emergency roaming arrangements.

II. DISCUSSION.

The Public Notice asks a number of focused questions about the impact of Hurricane Michael on network architecture, consumers, and service providers, and the Commission's response throughout the events.² Verizon below responds to those questions that relate directly to its services, and leaves responses to other questions to stakeholders best positioned to answer them directly.

A. Best Practices Mitigated Hurricane Michael's Impact on Verizon Customers and Enhanced Our Service Restoration Efforts (Service Provider Preparation and Response).

1. Were these best practices [e.g. from CSRIC] implemented? If so, how? If not, why not, and what were the major consequences of not implementing those best practices?

Verizon implemented the CSRIC best practices most relevant to Hurricane Michael, and our response focuses on them. A number of other practices have evolved over the years,

² *Public Safety and Homeland Security Bureau Seeks Comment on Hurricane Michael Preparation and Response*, Public Notice, PS Docket No. 18-339, DA 18-1176 (2018).

including: the best practices developed with local government stakeholders described in Verizon's November 26th response to the Bureau;³ the National Public Safety Telecommunications Council guidelines for public safety grade systems;⁴ and the ATIS/NRSC "hurricane checklist" established after Hurricane Katrina.⁵ Verizon incorporates relevant best practices into its internal policies and procedures as they are adopted and released over time. There are hundreds of ATIS/CSRIC and other best practices, many of which address the same or similar issues, but Verizon's January 2018 comments describing its efforts during last year's hurricane season listed some of the most relevant examples. Verizon has implemented these practices throughout Florida, including Bay and Gulf counties.

No. 9-7-5214 – "Network Operators, Service Providers and Property Managers should consider placing all power and network equipment in a location to increase reliability in case of disaster (e.g., floods, broken water mains, fuel spillage). In storm surge areas, consider placing all power related equipment above the highest predicted or recorded storm surge levels."

Placing network and power related equipment above storm surge levels is a business-as-usual practice for Verizon. When placing and designing cell sites in coastal areas, we account for factors such as wind, proximity to 100 year flood zones and the highest recent storm surge. And we build in accordance with state and local zoning and planning requirements, nearly all of which today account for factors such as storm surge and high wind. We apply these principles both to installations of new cell sites and to upgrades of existing sites that pre-date a particular

³ See CTIA, *Best Practices for Enhancing Emergency and Disaster Preparedness and Restoration*, <https://www.ctia.org/docs/default-source/default-document-library/best-practices-for-enhancing-emergency-and-disaster-preparedness-and-restoration.pdf?sfvrsn=0>, at 1-2 (2017); *infra* note 7.

⁴ See National Public Safety Telecommunications Council (NPSTC), *Defining Public Safety Grade Systems and Facilities*, Final Report (May 22, 2014).

⁵ See ATIS/NRSC, *Hurricane Checklist*, ATIS-0100019 (2006).

practice. In testament to Verizon's efforts, only a few of our sites in Bay and Gulf counties were knocked out of service due to storm surge or related damage as a result of microwave path alignment issues (which were resolved within 24-48 hours). In addition, our wireless switching facilities throughout Florida are built to withstand Category 5 hurricane winds. These switch locations boast tilt wall block construction built of concrete and rebar. To mitigate flooding risk, fiber enters the facility in two distinct locations to ensure additional redundancy.

No. 9-9-1067 – "Network Operators, Public Safety, Service Providers and Property Managers should consider, in preparation for predicted natural events, placing standby generators on line and verifying proper operation of all subsystems (e.g., ice, snow, flood, hurricanes)."

In preparation for Hurricane Michael, Verizon promptly moved deployable assets such as Cells On Wheels and Cells On Light Trucks (COWs and COLTs) from the Carolinas (where they were initially moved in preparation for Hurricane Florence from across the southeast), and prepositioned them, together with fuel resources, at preplanned staging areas as close as possible to the anticipated landfall location. We "topped off" all generators with fuel, and established refueling stations across six states to prepare for the storm.

No. 9-9-5204 – "Service Providers, Network Operators, Public Safety and Property Managers should ensure availability of emergency/backup power (e.g., batteries, generators, fuel cells) to maintain critical communications services during times of commercial power failures, including natural and manmade occurrences (e.g., earthquakes, floods, fires, power brown/black outs, terrorism). The emergency/backup power generators should be located onsite, when appropriate."

Verizon maintains battery backup power at 100 percent of its cell sites and backup generators at approximately 90 percent of its permanent sites. For the limited number of sites without a permanent generator located on-premises, Verizon deployed portable generators in advance of the storm. In testament to Verizon's efforts, none of our sites in Bay and Gulf counties were out of service long term due to the lack of backup power resources. Additionally,

because commercial power loss is often associated with hurricanes and tropical storms, our switching facilities have dual on-site generators and HVAC systems. (The switch facilities also serve as emergency operation centers and staging areas when hurricanes or other emergencies arise.) Our switching facilities also weathered Hurricane Michael without losing service.

No. 9-9-0655 – “Network Operators, Service Providers, Property Managers and Public Safety should coordinate hurricane and other disaster restoration work with electrical and other utilities as appropriate.”

The storm’s devastating impact in Bay and Gulf counties on all infrastructure, and the corresponding limited access to the affected area, made it difficult to coordinate with Gulf Power, the hardest-hit area’s electric utility. Both Verizon and Gulf Power needed to send vast numbers of employees and contractors to the area in a short period of time, with crews under enormous pressure to restore services. Rather than moving into an area after the utility has completed its initial work, as is typically the case to help avoid fiber cuts, our fiber provider’s crews had to perform their work at the same time and the same area as Gulf Power and its contractors. For Verizon, not only did that mean that the area often had not been cleared, but in many cases there was no utility pole available to which the fiber could be attached. (During the first week after the storm, Gulf Power replaced approximately 5,600 utility poles.) As a result, interim steps were needed to place fiber—including, in many places, stringing it through trees and even on the ground. And Gulf Power used 1,200 employees and 6,200 contractors from 15 states to restore service—a herculean effort on its part, but one that made inter-company coordination initially more challenging.

Once the circumstances on the ground were better understood, however, Verizon and Gulf Power engaged one another at the highest executive levels of their companies, and thereafter used the Bay County government emergency operations center to enable their

personnel on the ground to more directly coordinate recovery efforts with one another. Verizon worked with Gulf Power in an effort to stop the cuts and also launched a public relations campaign using signs, television spots and media outreach to educate the public more broadly on the need to avoid cutting fiber in restoration efforts. That continuing public relations campaign was particularly important as new contractors flooded into the area from other locations without knowledge of the cuts that occurred.

No. 9-7-0435 – “Network Operators, Service Providers, Equipment Suppliers and Property Managers should assess the functions of their organization and identify those critical to ensure network reliability.”

Verizon maintains a company-wide Business Continuity/Disaster Recovery (“BC/DR”) program that has evolved over the last two decades to incorporate lessons learned from disaster events. This program has defined objectives, time lines, organizational structure and ongoing management from a cross-functional leadership team that has the support of senior management. Our standard business procedures include risk assessments of critical functions and systems to evaluate the vulnerability of operations to disruptions, and result in the implementation of safeguards and protective measures to minimize the possibility of disruptions, for example by implementing battery and generator back-up power, hardening physical security, and diversifying operational locations and systems, as appropriate.

The BC/DR program also includes business impact analysis to rank criticality of functions and identify recovery time objectives. This has fine-tuned our recovery priorities and helps focus the BC/DR resources of the company and of the BC/DR program team. Verizon also selects recovery strategies as part of our standard delivery of products and services, system implementation programs, and as part of our BC/DR plan development efforts. The strategies are assessed and selected based on the potential risk and impact to company operations. Verizon

also maintains crisis management teams and a reporting structure to maintain command and control during emergency responses. This crisis management approach includes the process for activating teams, the infrastructure and resources to support the teams, and the integration of business continuity plan activation. Verizon also provides internal training and increases awareness of BC/DR program initiatives through multiple channels, including general employee alerts, completion of training and exercise sessions, maintaining an internal BC/DR website for employees, and through the risk and criticality assessment process. Verizon conducts exercises of BC/DR plans and crisis management teams on a regular basis. Exercise results are documented, focus on lessons learned, and may result in follow up action items for the teams involved. And for Hurricane Michael in particular, Verizon participated in a joint after-action review through the NCC with representatives of service providers, electric utilities, FEMA, the Commission, and Florida and North Carolina emergency management agencies.

No. 9-7-0496 – “Network Operators and Property Managers should consider storing their portable generators at critical sites that are not otherwise equipped with stationary generators.”

If Verizon is able to maintain a generator on-site, we will install a permanent generator rather than store a portable one. So, our use of this best practice focuses on placing portable generators where they would do the most good. As noted above, Verizon delivered portable generators to those sites in the affected area that do not have permanent on-site generators. We also deployed portable generators in close proximity to areas that were certain to be hit—which, as a practical matter, is often more appropriate than storing them on-site as it is not possible to know with 100 percent certainty where a hurricane landing will cause the most damage.

No. 9-7-1050 – “Network Operators and Service Providers should consider tertiary carrier/transport methods such as satellite, microwave or wireless to further reduce point of failures or as ‘hot transport’ backup facilities.”

Verizon's preferred mode of transport, including in Bay and Gulf counties, is using a fiber ring configuration with three levels of redundancy, minimizing the risk that fiber cuts will disrupt service in the first instance. (As described below at Questions 4-5, all three fiber rings were severed during the storm and re-severed in the days afterward.) When it became clear that fiber cuts would likely continue to delay service restoration, Verizon used: fiber from another provider; microwave technology to turn up service to nearby cell towers that were still cut off from the fiber network; several SPOTs ("Satellite PicoCell on Trailer") in Bay County; and an unmanned aerial vehicle (UAV) to provide some limited coverage to Mexico Beach. Verizon also leveraged satellite-based backhaul by deploying MPU-5 radios using unlicensed spectrum, which create a mesh network configuration among the users' devices. These were deployed to a number of critical locations including Gulf Coast Regional Hospital in Panama City, a makeshift staging area for local fire and EMS crews, and for the city government in Mexico Beach.

2. *In cases where certain best practices were not implemented, would their implementation have prevented, or at least mitigated outages, and/or enhanced restoration in the affected areas?*

As described in response to Question 1, Verizon has implemented, and relies heavily on, these and other best practices. While these best practices both mitigated the extent of the outages throughout the counties in Florida and Georgia affected by Hurricane Michael, and enhanced our service restoration efforts even in the hardest hit areas of Bay and Gulf counties, Verizon was frustrated with the pace of our recovery efforts in those counties. How service providers apply best practices to their decision making and operations, though, is always an iterative process in which "lessons learned" during a particular disaster are applied to future preparation efforts. As with all disaster events, Verizon conducts an after-action review of its performance that includes necessary corrective actions. And given the magnitude of Hurricane Florence and Hurricane Michael, the NCC conducted a joint after-action review with representatives of service providers,

electric utilities, FEMA, the Commission, and Florida and North Carolina emergency management agencies.

Verizon's actions before and after Hurricane Michael show how that iterative process works. For example, our experience during Hurricane Irma last year and more recently in response to wildfires illustrated the potential benefits of deployable facilities that use satellite connections for backhaul; our experience in Bay County will refine how we deploy those facilities to areas where backhaul repairs may extend longer than forecasted. Our experience in coordinating recovery efforts with Florida P&L after Hurricane Irma provided insight on how best to coordinate efforts when wireless providers are able to follow utility crews as areas are cleared of debris and backhaul repairs are maintained; our experience in Bay County illustrated that a different type of coordination is needed where the power company loses the poles on which we rely for fiber placement. And industry's experience in Hurricane Maria illustrated the potential benefits of roaming arrangements; after Hurricane Michael we better understand the technical issues to overcome to implement roaming during disasters, which will enable us to use available roaming opportunities more quickly going forward.

3. *To the extent these best practices involve cross-industry and/or government participation, was such participation available and effective?*

Yes – see our response to Questions 1-2.

4. *Why did restoration in [Bay County and Gulf County] take additional time and what can be done to expedite service restoration in the future?*
[and]

5. *What do service providers believe were the obstacles to restoring communications systems almost a week after Hurricane Michael?*

As noted in the introduction, the extensive and recurring damage done to the fiber rings in the Panama City area was the primary cause of the extended delay in restoring wireless service to the hardest-hit counties. Fiber crews worked 24 hours a day to effect repairs, but faced two

major challenges: accessing fiber rings blocked by debris (both from the storm and from restoration and clearance activity afterward) and repeated fiber cuts by electric contractors, road contractors and homeowners. But for the ongoing man-made fiber cuts, Verizon could have brought most of its network back up several days earlier than it did.⁶

Background – Verizon’s Network. Much of the fiber Verizon uses to serve its wireless facilities in the Florida Panhandle is installed underground. Ordinarily, that fiber is more subject than aerial facilities to fiber cuts due to utility excavations and other construction activities, and cuts in underground fiber take longer to repair. (In Mexico Beach, for example, access to underground fiber lost to flooding was blocked by an unmoored house, and several times underground fiber was cut as new electric poles were installed.) Underground fiber, though, is normally well-protected from the high winds, falling trees, and flying debris generated by a hurricane. Most of the fiber used to serve Verizon’s network in and near Panama City was aerial (i.e. attached to utility poles). Aerial fiber is faster and less disruptive to local governments and citizens when it is deployed, less likely to be cut in the ordinary course, and more accessible and therefore easier and faster to repair when it is cut. But because Michael hit in this area where much of the fiber serving Verizon’s wireless facilities was aerial, it caused multiple cuts to the fiber backhaul network that had to be repaired before service could be restored. Fiber cuts alone would not necessarily have delayed service restoration for so long, but the magnitude of the initial and ongoing cuts did in this case.

Verizon’s Service Restoration Efforts. The principal source of the delay in restoring our network was repairing the core and access fiber rings—and keeping them repaired. Immediately

⁶ Steps to expedite service restoration in the future are addressed in our responses to Questions 2 and 9.

after the storm passed through the Panama City area, Verizon and its contractor, Uniti, began to assess the damage wrought by the storm. Uniti began work before dawn on Day 1 (October 11, the day after the storm), cutting through debris to reach the affected areas. Initially, Uniti crews worked 24 hours a day. By Day 5, Uniti crews started working 12 hour shifts, a day shift and a night shift. Ultimately, Uniti had 300 crew members in the area working on network restoration, using 25 bucket trucks. Fiber repair is time-consuming work, taking 4-8 hours for aerial facilities and 12-16 hours for underground facilities in the best of circumstances—which hardly existed after Hurricane Michael. Fiber bundles can include up to 288 glass fibers, so that when the bundle is cut each glass fiber on one side of the cut must be heated and fused with the corresponding glass fiber on the other side of the cut. If the fiber bundle is severely damaged—such as when a contractor cuts through it roughly with a chain saw—there may not be enough slack left in the line to simply connect the fibers at the two exposed ends of the bundle. Rather, a length of new bundled fiber must be used and spliced to each end of the cut fiber, doubling the work.

As the fiber repair progressed, two major challenges emerged: (i) accessing fiber rings, fiber hubs, and cell towers: and (ii) repeated fiber cuts by electric contractors, road contractors and homeowners.

- Access. High winds, falling trees, and debris strewn in the wake of Michael blocked roads, wrecked utility poles and piled on top of downed fiber bundles, which slowed the progress of Uniti fiber crews. Uniti uses equipment to detect fiber cuts, by testing how far a signal can travel before it is obstructed. Crews then can locate the cut, fix it, and use the equipment again to locate the next one. As Uniti crews pressed on, they had to deal with new impediments created by road crews moving debris to the side and homeowners clearing their property. Night work, facilitated by high intensity lighting, proved more efficient because roads were clear of traffic and crews could focus on fiber repairs exclusively rather than also taking measures to prevent more fiber cuts.

Obtaining access was more difficult than usual after a storm because Uniti crews were doing their work at the same time as Gulf Power and its contractors, rather than being able to follow behind the power restoration crews. Not only did that mean that the area often had not been cleared, but in many cases there was no utility pole available to which the fiber could be attached. During the first week after the storm, Gulf Power replaced 5,600 utility poles. Rather than waiting for poles to be replaced, Uniti crews repaired fiber and made on-the-ground decisions about how to place it in the interim before it could be reattached to poles. Often the fiber simply had to be left on the ground while it was used to serve customers again.

- Fiber Cuts. Repeated fiber cuts that took place after the storm plagued recovery efforts. While many cuts related to Gulf Power's efforts to repair the electric grid, as noted above, other cuts were made by road contractors and homeowners as they cleared debris. In the Panama City area, there were dozens of manmade cuts to Verizon's fiber, more than the number of cuts caused by the storm itself. Many of these cuts were to fiber that had just been restored. So many cuts were made that in some cases new fiber was deployed instead of repairing the existing fiber because attempting to repair all the cuts would take too much time. By early November, the fiber network backbone had been replaced twice in many areas and three times in others.

Over the first week after the storm, Uniti and Verizon restored service to cell towers from the periphery of the affected area inward, while simultaneously working within Panama City to prepare sites so the network could function once connectivity from the local area to Tallahassee had been reestablished. By Day 7, the extensive damage to the fiber hubs serving downtown Panama City had been placed back in service and most of the fiber network had been repaired. On Day 8, network service was brought back up for most of Panama City, but was knocked out after only 9 minutes because of another fiber cut. Service was not substantially restored for another four days as repeated cuts had to be addressed. Even after Day 12, when service was back, the fiber cuts continued. Fortunately, by that time redundancy had been reestablished so that cuts did not bring down the network.

By comparison, in Tallahassee where there were few manmade cuts, the experience was much different. Tallahassee also experienced a large number of storm-related cuts, but in the fiber network there was restored relatively quickly and few outages occurred after wireless service was restored.

6. *To what extent were service providers able to pre-position equipment, supplies, and/or resources close to the affected areas in advance of the storm?*

See response to Question 1 above. Verizon was able to effectively pre-position necessary resources at yards, garages, and warehouses (as appropriate) at our own switching facilities and our contractors' business locations.

7. *How did the pre-positioning of such assets impact the continued availability of communications services during the storm?*

See responses to Questions 1, 2, and 6 above.

8. *How did the pre-positioning of such assets facilitate or, where resources were not pre-positioned, impede recovery?*

See responses to Questions 1, 2, and 6 above.

9. *What were the most effective means to restore connectivity within the communications infrastructure, and how long did it take to do so?*

See response to Question 5 above. As an interim measure, the use of deployable assets to re-establish some service backhaul capability, such as satellite-connected SPOTs, COLTs, and microwave paths for temporary connection of existing cell sites, were effective near-term measures that enabled some limited service, particularly for local governments and first responders. While satellite assets provide limited bandwidth as compared to the fiber network, going forward we expect to use those assets more extensively. The most effective means to restore full connectivity on a more permanent basis is to dedicate the time and investment in personnel, 24/7 repair efforts, and other resources and activities necessary to re-splice, replace, and re-install damaged fiber as needed—which we did.

- 10. News outlets and DIRS reported situations of fiber cuts during restoration. Even ten days after the storm hit, companies reported in DIRS that major fiber facilities were still out of service in Florida. Many communications providers reported having restored fiber links disabled by repair efforts from other entities, include power utilities. How often and when did these cuts occur? What caused these fiber cuts? What steps, if any, did service providers take to minimize such cuts?**

See response to Question 5 above.

- 11. Were other communications services, such as satellite services, mobile ad-hoc networks, Wi-Fi services, mesh-based communications architectures, experimental projects, or other services/technologies used and effective in providing connectivity? In what ways did these technologies compensate for the damage to wireline facilities, particularly those used for wireless backhaul, during the response? Should the FCC encourage the inclusion of such services—including power utilities—in future mitigation plans?**

See responses to Questions 1 and 9 above. Existing best practices for communications service providers largely address this issue already.

- 12. How were 911 call centers, also known as Public Safety Answering Points (PSAPs), affected by Hurricane Michael?**

In accordance with our standard practice, we engaged with PSAPs and their wireline 911 providers to help troubleshoot whether 911 connectivity issues related to our network, the wireline 911 network (e.g. the Selective Router), or equipment at the PSAP's premises.

- 13. Were PSAPs able to receive 911 calls, and did redundancy and diversity in the circuits to the PSAPs contribute significantly to 911 reliability?**

In accordance with standard practice and Commission 911 call routing requirements, PSAPs direct wireless providers regarding the selective router(s) to which we route wireless 911 calls. In these areas, Verizon has been directed to connect to one selective router per PSAP. PSAPs in the area have also, as a general rule, provided 10-digit administrative line numbers for us to deliver 911 calls should the E911 trunks to the selective router be blocked.

16. For service providers, were there any issues with the transmission of the EAS or WEA messages?

During Hurricane Michael, Verizon broadcast over 30 WEA alerts from the National Weather Service (“NWS”) and local authorities to the designated areas. This includes an alert from the Bay County Emergency Management agency on October 15. We are not aware of any issues in transmitting these alerts.

- 17. To what extent was the [Wireless Resiliency Cooperative] Framework and each of its elements (i.e., requesting roaming, providing mutual aid to service providers, enhancing municipal preparedness, increasing consumer readiness, and publishing DIRS aggregated data) effective or not, in the affected areas?**
- 18. What are examples of positive impacts and/or deficiencies in wireless service providers’ use of the Framework, and, if so, what should be improved?**

As explained in our November 26th response to the Bureau’s inquiries concerning the use of the Wireless Resiliency Cooperative Framework (the “Framework”) during 2017-2018, the Framework is an important component of our overall effort to restore our networks for customers who depend on them and to assist other carriers in times of need. Verizon’s use of each of the relevant Framework elements for Hurricane Michael is detailed in that earlier response.⁷ As explained, Verizon’s adherence to the Framework worked as intended, and our use of roaming arrangements, mutual aid, support of and participation with the affected municipal and state governments, and consumer and stakeholder outreach, ultimately contributed to our service restoration efforts and helped to mitigate the impact on consumers and first responders.⁸ We are nevertheless incorporating lessons learned based on our experience implementing the Framework’s elements. These include establishing better-defined criteria for handling disaster-

⁷ See Attachment 1 – Verizon Response to Public Safety and Homeland Security Bureau Letter of November 6, 2018, PS Docket No. 11-60 (Nov. 26, 2018).

⁸ See *id.*

related roaming requests (both inbound and outbound) and leveraging local EOCs to facilitate information sharing among service providers, local government emergency management personnel, and electric utility representatives.

B. The Commission Maintained the Diligent, Timely and Thorough Preparations and Response It Has Used for Previous Disaster Events (Prospective Improvements to FCC Response).

23. *Are there tools or practices that the FCC should consider to improve its response and post-disaster restoration efforts?*

The Commission has established a consistent, helpful routine of outreach to the public and to communications service providers in advance of and after disasters strike. As in the 2017 hurricane season, Commission staff were available and active in their support of service provider and federal and state/local government efforts, both through the U.S. Department of Homeland Security's NCC-ISAC program and in their proactive support for service providers' recovery efforts. The Commission's timely actions are all the more commendable given the need for all parties to quickly pivot from the impact of Hurricane Florence in the Carolinas.

24. *The Commission kept DIRS active for 16 days. What DIRS information proved most useful to first responders? Are there extraneous or unnecessary data points contained in DIRS that detract from its overall usefulness?*

Verizon has already stated that disclosure of provider-specific DIRS information to assist first responders' situational awareness—subject to critical confidentiality and use safeguards—could make it more helpful to state and local emergency management agencies.⁹ In practice, however, direct communications between service providers and state and local government

⁹ See Verizon Ex Parte Letter, PS Docket No. 15-80 (Oct. 31, 2018); Verizon Comments, PS Docket No. 15-80 and ET Docket No.04-35, at 12-13 (July 16, 2015); *see also* Verizon Comments, PS Docket No. 15-80 and ET Docket No.04-35, at 8-9 (July 31, 2015); Verizon Reply Comments, PS Docket Nos. 15-80 and 11-82 and ET Docket No.04-35, at 4-6 (Sept. 12, 2016).

emergency management agencies via the NCC and relevant state and local EOCs will be more helpful in coordinating repair and recovery efforts.

25. *What improvement could be made to DIRS to minimize burdens on participating service providers, improve the quality of information, and otherwise streamline the process?*

Verizon had no problems with either Bureau staff's delivery of DIRS notices or completing and timely filing DIRS reports. Staff updated the list of reportable counties as the storm progressed, which helped our personnel to prepare the information in a relatively orderly and efficient manner. During 2018 and in the wake of industry's experience with Hurricane Maria, there have been constructive discussions between industry and Bureau staff to supplement the information voluntarily provided to the Commission during DIRS events. Any changes will ultimately require Paperwork Reduction Act approval, but that information is intended to provide the Commission and FEMA a higher level of situational awareness that could potentially improve disaster response activities.

26. *What specific improvements could be made to DIRS to make it more useful for users like FEMA? For example, what additional information, including licensee information, could improve response and coordination efforts?*

See the above response to Question 25. In addition, formalizing the provider-specific points of contact that already are informally shared through the NCC and other venues could improve coordination efforts.

27. *The FCC also created a webpage dedicated to Hurricane Michael, to include public notices, Commission orders, news releases, statements, and presentations. From that website, the public could download daily communication status reports giving an overview of the communications situation in affected areas. Were those reports useful, and how might they be improved?*

As in earlier storms, the Commission's DIRS-related status reports during Hurricane Michael enabled Verizon to compare its own experience and observations in the field with the

aggregate experiences of other service providers. While Verizon's monitoring systems provided us with comprehensive insight into the affected geographic areas and service impacts of any given outage, this additional aggregated information provided the added benefit of affirming where service restoration challenges were widespread across service providers and not specific to Verizon. It also provided some comparative benchmarks that Verizon (and all service providers) can use internally as an incentive to improve network reliability even more in future events. In this important respect, the Framework's DIRS reporting commitment has had the desired effect of using the competitive marketplace to drive network reliability across the industry.

The Commission recently issued a report and recommendations on the 2017 Atlantic Hurricane season. Beyond the recommendations in that Report, are there other actions the FCC should consider to improve its response to hurricanes and disasters, and if so, what would those be?

The recommendations in the 2017 Atlantic Hurricane Season Report relevant to the Commission itself also focus on coordination and information sharing with other Federal government agencies. But as Hurricane Michael and other events have shown, the support of state emergency management agencies, their local government partners, and other critical infrastructure sectors are at least as important to the success of service providers' service restoration efforts. The Commission should thus consider supplementing the 2017 Report recommendations with potential ways of achieving more local government participation in state EMAs' efforts, and more robust lines of communication between the NCC, state EOCs and local EOCs.

The Commission should also revisit its role in supporting a diverse and competitive public safety communications marketplace for first responders and the state and local governments who support them, as such diversity promotes continuity of communications during times of disaster. As explained in our November 26th response, Verizon was able to rely to a

limited degree on another provider's network in Bay County for certain customers, while in many other counties, Verizon's network outperformed others. When significant disasters occur, state and local public safety agencies benefit from having access to multiple networks that are designed to serve the unique needs of first responders. Without interoperability between these competing systems, however, first responders will not have access to all the tools they need. Verizon and FirstNet have each implemented an LTE network core dedicated to public safety, and are providing priority and preemption features to address public safety's unique needs. Other network providers may soon do the same. Public safety agencies cannot fully benefit from these significant developments, however, unless there is full interoperability at the network, service, and application levels between FirstNet, Verizon, and other public safety communications networks. Verizon supports such interoperability and encourages the Commission to promote actions that encourage its broader adoption.

C. Verizon Expanded the Outage-Related Information Available to Consumers and the Media (Communications Service User Experience).

28. *How did service providers make consumers aware of the specific causes of the apparent prolonged communications outages following Hurricane Michael?*

During and after Hurricane Michael we used social media to update customers and local media on matters like network status, store openings and charging stations and other mobile support locations, and the availability of free service to affected customers in the affected area. We also provided public online updates of our recovery efforts, which explained the specific causes of our prolonged outages in Bay and Gulf Counties.¹⁰ And we initiated a significant press

¹⁰ See <https://www.verizon.com/about/news/hurricane-michael-network-updates>.

and stakeholder education campaign to help educate the public to mitigate the recurring fiber damage that substantially hindered our recovery efforts.¹¹

29. *How do service providers determine what effect these outages had on consumers directly?*

Verizon's monitoring systems provided the company with a comprehensive insight into the affected geographic areas and service impacts of any given outage. These systems inform us on the geographic area of coverage loss, and the services affected (e.g. voice, text, data, 911 connectivity).

30. *Were consumers able to effectively reach 911 services during and after Hurricane Michael? If not, please provide specific information, such as the date and time of any communications (or attempted communications), the service provider's name, and any follow-up efforts made, whether by consumers or the provider.*

Not surprisingly, users' ability to dial 911 via our wireless network tracked the state of our macro network in the counties most affected by the storm. 911 call attempts originating on our network dropped significantly after the storm in those counties, and increased as we restored service. It is possible, however, that handset 911 dialing protocols, which search for available networks regardless of roaming agreements, would have enabled some Verizon customers to dial 911 on other providers' networks. PSAP-originated ALI/ANI queries likewise indicated that completion of Verizon 911 calls at a PSAP's premises tracked the condition of the PSAP's network – i.e., the percentage of Verizon's 911 calls that received a PSAP query increased as the PSAPs and their vendors restored their own services. (Dozens of PSAPs in Florida and Georgia were affected by the storm.)

¹¹ See <https://www.verizon.com/about/news/verizon-wireless-services-and-running-panhandle-dont-cut-fiber>.

31. *Over a quarter of Floridians speak a language other than English in their homes. Were emergency communications services available in languages other than English?*

Verizon has provided Spanish language information in our press statements for prior storms that affect areas with sizeable Spanish-speaking populations (including Hurricane Irma in southern Florida and Hurricane Maria in Puerto Rico) but did not do so for Hurricane Michael in northern Florida. But Verizon maintains 24/7 customer care for Spanish-speaking customers. And as part of our broader public relations effort to prevent further fiber cuts, we placed signage on fiber in English and Spanish warning people not to damage the fiber and cause more communications outages.

32. *Were emergency communications available and in formats accessible to people with disabilities and others with specific communications needs?*

Implementation of text-to-911 services has been one of the most important Commission efforts to support access to emergency services for individuals with disabilities. Some of the affected counties in Florida have deployed text-to-911 service, including Gulf County, Calhoun County, and Collier County. Many other jurisdictions affected by the storm have not implemented text-to-911, however, and the Commission should continue to encourage state and local authorities to take this important action.

33. *Did providers deliver WEA and/or EAS alerts and if so, when and where? Did consumers receive WEA and/or EAS messages in connection with Hurricane Michael and, if so, were they helpful?*

See response to Question 16 above.

34. *Did consumers notify their service providers about outages? If so, how were those concerns addressed?*

Verizon customer care representatives were notified of the outages and service restoration challenges we experienced after Hurricane Michael outage in the hardest hit counties,

where to find available information on service restoration status, and how affected customers could take advantage of free voice and text service.

35. *Did service providers respond to questions or complaints about communications outages quickly and appropriately?*

Consumer complaints or inquiries regarding the availability of wireless service would have been fielded through different channels at Verizon, including customer care calls and our retail stores. Our monitoring systems and alarms, however, will have detected a service outage before complaints are received, and were and must remain the principal trigger for addressing service outages through formal “trouble tickets.” Nonetheless, as in previous events, customer care representatives were notified of the outages and service restoration challenges we experienced after Hurricane Michael outage in the hardest hit counties, where to find available information on service restoration status, and how affected customers could take advantage of free voice and text service.

What measures could either service providers or the Commission consider to improve the capability of service providers to ensure that consumers have adequate information and accessibility to communications during and after a disaster?

The conundrum of informing wireless users about service availability is that the service provider’s principal method of communication may not be available to the user. To increase the likelihood of affected customers obtaining useful information Verizon diligently notifies local media outlets and government agencies where we have re-opened retail stores, trucked in charging stations, and restored service. Other service providers maintain similar practices. But to build upon these efforts and improve the likelihood that affected consumers will receive the necessary information, the Commission might engage those other state and federal government agencies and relief organizations who interact more directly with consumers after disasters—such as FEMA and the Red Cross—to maintain a practice of providing service availability

information like retail store locations, charging station locations, and other resources, in areas where they are providing disaster relief directly to consumers.

III. CONCLUSION

Verizon looks forward to opportunities to discuss our Hurricane Michael experience with the Commission, industry and other government stakeholders.

Respectfully submitted,

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December 17, 2018